Bird habitat benefits of using switchgrass for biomass fuel in the U.S. Midwest

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Introduction

Habitat loss is a major factor contributing to the decline of grassland birds. In the U.S. Midwest, most of the native prairie has been lost to agricultural and urban development, but other grassland habitat is available for birds. Before 1985, most of the grasslands in Iowa were in pasture and hay, but grazing and mowing have negative effects on birds, including low nest success [1,2]. After 1985, the Conservation Reserve Program (CRP) has provided undisturbed grasslands by reimbursing farmers for removing cropland from production and planting fields to perennial cover, commonly grasses. The CRP has benefited grassland birds because many bird species are more abundant and nest more often in CRP fields than in rowcrop fields [3]. Switchgrass (*Panicum virgatum*), grown for use as a biomass fuel, could provide similar benefits to grassland birds. Harvest of biomass fields would not directly affect nest success because the harvest takes place in the fall or winter. Species composition, abundance, and nest success of birds, however, may be affected by changes in vegetation structure due to harvesting. For example, grasshopper sparrows are more abundant in short, sparse grasslands and would be expected to use harvested fields because of the removal of residual vegetation, whereas northern harriers and sedge wrens would be expected to use non-harvested fields because residual vegetation is present. If fields were harvested in strips, then both habitat types (cut and uncut) would be provided within a field. Biomass fields would likely replace rowcrop fields in the future, therefore it is also important to evaluate the differences in the bird community between rowcrop fields and switchgrass fields.

Methods

Our study was conducted in 1999 and 2000 on 21 CRP switchgrass fields in southern Iowa using a randomized complete block design with 7 replicates of each of 3 treatments (total-, strip-, and non-harvest). Strip-harvest fields consisted of alternating cut and uncut strips with 60% of the field being harvested. When harvested the residual switchgrass was cut at a height of 9 cm with a disc mower, baled, and removed between November and March.

Vegetation density and maximum height were measured once every 2 weeks from mid-May to late July. Percent canopy cover of plants and litter depth were measured in mid-June and in mid-July. Canopy cover (%) was estimated for switchgrass, other grasses, broad-leaved plants, woody plants, standing dead vegetation, litter, and bare ground. We surveyed birds once per week in all 21 fields and systematically searched 15 fields for nests between 15 May and 15 July. Nests were marked and checked every 3 days until the nest failed or fledged young. Bird abundances and species composition in biomass fields were compared with reported results in rowcrop fields [3], and a Geographic Information System (GIS) was used to model bird abundance in scenarios with various amounts of switchgrass and rowcrop.

Results

Vegetation density and maximum height were not significantly different among treatments. However, vegetation was denser and taller in 2000 than 1999 in total- and strip-harvest fields, likely because of the application of fertilizer. In both years, total-harvest fields had less standing dead and more exposed bare ground than fields of the other 2 treatments. Litter depth was significantly different among treatments and deepest in non-harvest fields followed by strip-harvest fields.

The mean number of bird species seen per field for total-, strip-, and non-harvest fields were 15.3, 13.2, and 12.6, respectively. Fifty-one species were seen overall. Thirty species were seen in all 3 treatments, 9 in 2 treatments, and 12 species in only 1 treatment. Although the number of bird species was not

significantly different among treatments, abundances differed among treatments for some species. Grasshopper sparrows were more abundant in total-harvest fields than in fields of the other 2 treatments. Grasshopper sparrow abundance was negatively related to vegetation height and positively related to the amount of bare ground. In contrast, northern harrier and sedge wren abundances were higher in non-harvest fields than total-harvest fields and positively correlated with vegetation height, litter depth, and the amount of residual vegetation in a field. Common yellowthroat and red-winged blackbird abundances did not differ among treatments, but these species used uncut strips more often than cut strips in strip-harvested fields. Seventy-five percent of common yellowthroat and 66% of red-winged blackbird observations were in uncut strips. Also, the residual vegetation in uncut strips provides nest cover and support for some species. Eighty-six percent of common yellowthroat and 91% of red-winged blackbird nests were in uncut strips. In addition, 5 of 7 northern harrier nests were in non-harvest fields and the remaining 2 were in uncut strips.

Nest success was calculated only for common yellowthroats and red-winged blackbirds because of the small number of nests found for other species. Overall nest success for common yellowthroats was 47% with no differences among treatments. Red-winged blackbird overall nest success was higher in non-harvest fields (54%) than in strip-harvest fields (31%).

Sedge wrens, common yellowthroats, red-winged blackbirds, and song sparrows were more abundant in all 3 treatments than in rowcrop fields [3]. Also, grasshopper sparrows were more abundant in total-harvest fields than in rowcrop fields. Horned larks and vesper sparrows, however, were more abundant in rowcrop fields than in switchgrass fields. We will display GIS generated maps modeling bird abundance in a landscape with various amounts of switchgrass and rowcrop.

Conclusions

In general, switchgrass fields support a more diverse and abundant bird community than rowcrop fields. Total-harvest switchgrass fields create suitable habitat for grasshopper sparrows, but the removal of residual vegetation reduces northern harrier and sedge wren abundance in total-harvest fields. Strip-harvest fields do not attract grasshopper sparrows into cut strips because of the species' area requirements. Strip-harvest of biomass fields in southern Iowa should be considered, however, because the residual vegetation remaining in uncut strips provides benefits to other bird species. Another option is a mixture of non-harvest and total-harvest fields; because the presence of both habitats would benefit grasshopper sparrows, sedge wrens, and northern harriers.

References

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